SOUTHWEST FISHERIES CENTER

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August 1986

# SKIPJACK FISHERIES OF THE SOUTHWEST PACIFIC

John Sibert
South Pacific Commission
Noumea, New Caledonia

NOT FOR PUBLICATION

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## PREFACE

This report represents a written presentation for the workshop on **Forces of Change in Hawaii's Aku (Skipjack Tuna) Industry** held in Honolulu on April 30 and May 1, 1986. The workshop was coordinated by the National Marine Fisheries Service, Southwest Fisheries Center Honolulu Laboratory. Workshop results will be summarized in a forthcoming Southwest Fisheries Center Administrative Report.

The workshop presentations were prepared by independent scientists and are reported here verbatim. Therefore the results, conclusions, and recommendations are those of the author and do not necessarily represent the views of the National Marine Fisheries Service.

# SKIPJACK FISHERIES OF THE SOUTHWEST PACIFIC

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## Introduction

Skipjack have been an important traditional fisheries resource for many generations of Pacific islanders. With the rapid expansion of industrial tuna fishing in the southwest Pacific, the South Pacific Commission has been given the task of monitoring catches and generally assessing the state of southwest Pacific tuna fisheries. This paper summarizes information on the fisheries for skipjack tuna (Katsuwonus pelamis) with particular attention to current conditions, prospects for further development, and possible interactions with the Hawaiian Aku fishery.

## Data Sources

The SPC uses several sources of data on the commercial fisheries of the South Pacific. Published summaries, suitable for general analysis, are prepared by Japan, Korea and Taiwan and provide valuable historical perspective on the development of the fisheries up to about 1980. Logsheets of daily fishing activities by vessels licensed to fish in the EEZs (Exclusive Economic Zones) of SPC member states are the most useful source of information available for scientific purposes. On-board observers gather information not normally included on the logsheet forms such as sizes of fish caught and species composition of bycatch. Information from other agencies in the form of published reports and analyses can often be brought to bear on the problems addressed by the SPC.

A particularly important source of information for skipjack fisheries is the results of the SPC Skipjack Survey and Assessment Programme which tagged and released some 140,000 skipjack between 1977 and 1980 (Kearney 1983). These results provide population estimates, measures of population dynamics, and valuable information on the net movement pattern and the potential for exchange between Hawaiian and South Pacific skipjack stocks.

## Historical Development

Skipjack are commercially harvested in the southwest Pacific by two principal methods: pole-and-line (or live-bait boat) and purse-seine. Pole-and-line fishing for skipjack has gone through several episodes of expansion. The first of these occurred in the 1920s and 1930s when the Japanese fishermen began operations in the Mariana Islands and western

Micronesia. These activities were halted by the war, but resumed in the late 1940s and gradually expanded as newly developed techniques for holding and transporting bait enabled vessels to fish in more remote locations (Matsuda and Ouchi 1984).

In the 1970s high prices for tuna stimulated efforts towards development, often through joint ventures, of locally based pole-and-line fleets in several island countries such as Kiribati, Tuvalu, Papua New Guinea, Solomon Islands and Fiji. Some of these fisheries have prospered while others have suffered. The major biological factors determining the success of pole-and-line fisheries have been availability of bait and seasonal variability in skipjack abundance.

Purse-seine fishing for skipjack began in the late 1970s and expanded to a total annual harvest of over 300,000 tonnes in 1984. This harvest is almost entirely taken in large scale fishing operations by Japanese and United States distant-water fleets, but there are also some reasonably successful intermediate scale, locally based, purse-seine operations in Fiji and Solomon Islands.

The historical development and future prospects of skipjack fisheries in countries of the SPC region are documented in a series of 20 different reports on individual countries which can be obtained from SPC headquarters.

## Current Conditions

The distribution of total pole-and-line skipjack catch for the years 1982-85 is shown in Figure 1. This figure is based primarily on data from distant-water fleets. Some data from locally based fisheries are included but some important local fisheries are missing. The continuing importance of the Micronesian fishery is particularly clear.

The distribution of total purse-seine skipjack catch as reported to the SPC for the years 1982-85 is shown in Figure 2. This figure is also based primarily on data from distant-water fleets, but includes data from some locally based fisheries as well. The purse-seine fishery is less dispersed than the pole-and-line fishery, and a very large portion of the catch is taken in a relatively small area of western Micronesia and northern Papua New Guinea.

Days searched plus days fished is a useful measure of fishing effort for both pole-and-line and purse-seine fleets. Recent trends in this measure of fishing effort and in skipjack catch in the area between 1000°N and 1500°S latitude and 14000°E and 18000°E longitude can be seen in Figures 3 and 4. The rapid growth of purse-seine fishing relative to pole-and-line fishing is clearly evident. In 1982, fishing effort and catch by purse-seiners surpassed effort and catch by pole-and-liners.

Changes in fishing success for skipjack are shown in Figure 5. Catch per unit of fishing effort (CPUE) for the pole-and-line fleet has remained relatively constant during recent years in spite of the intense development of the purse-seine fishery. Catch curves, relating catch to fishing effort, for skipjack fisheries are shown in Figure 6. Catch is roughly proportional to effort for both purse-seine and pole-and-line fishing, suggesting that skipjack stocks have been relatively lightly affected by fishing and could sustain increased harvests. It is likely that harvests of skipjack will in fact increase in spite of the currently low prices because they are frequently caught by purse-seiners in the western Pacific in association with yellowfin tuna (Figure 7).

## Tagging Studies

One of the major conclusions of the SPC skipjack survey was that fisheries at the time (1980) were harvesting only a small fraction of the potential yield of the region. The total stock was estimated to be about 3,000,000 metric tonnes with a monthly turnover of about 17% yielding an estimate of approximately 6,000,000 tonnes for the annual flux of skipjack in the region (Kearney 1983; Kleiber, Argue and Kearney 1983). Recent increases in skipjack harvests have not increased the harvested fraction significantly confirming the conclusion from examination of catch statistics that skipjack stocks can sustain greater harvests.

Figure 8 shows the resulting net movement pattern from the tag returns. While some skipjack make long migrations, no tags were returned to the SPC from Hawaii. Close examination of this figure shows that only a single arrow has been drawn in each direction between any pair of ten-degree geographic squares in order to preserve the clarity of the figure. Thus, the shorter arrows represent many tags moving relatively short distances from point of release to point of recapture.

The proportion of fish moving different distances over different periods of time is presented in Figure 9. Most of the tags were recovered within a few hundred miles of the point of release. The distance covered obviously depends on time, but the total attrition rate (about 17% per month) reduces the number of fish which actually accomplish long migrations.

The tagging results therefore indicate that South Pacific fisheries are not having an adverse impact on Hawaiian fisheries. None of the nearly 6,000 tags returned to the SPC were returned from Hawaii. The majority of returned tags made relatively short (less than 300 nmi) migrations and the estimated attrition rate is very high. The conclusion is that Hawaii is too far removed from the South Pacific for fisheries in the two areas to be closely connected.

## References

Kearney, R.E. 1983. Assessment of the skipjack and baitfish resources in the central and western tropical Pacific Ocean: a summary of the Skipjack Survey and Assessment Programme. South Pacific Commission, Noumea, New Caledonia, 37 pp.

Kleiber, P., A.W. Argue and R.E. Kearney. 1983. Assessment of skipjack (Katsuwonus pelamis) in the central and western Pacific by estimating standing stock and components of population turnover from tagging data. Tuna and Billfish Assessment Programme Technical Report No.8, South Pacific Commission, Noumea, New Caledonia, 38 pp.

Matsuda, Y. and K. Ouchi. 1984. Legal, political and economic constraints on Japanese strategies for distant-water tuna and skipjack fishing in southeast Asiand seas and the western central Pacific. Mem. Kagoshima Univ. Res. Cent. S. Pacific. 5(2):151-231.

Captions for Figures

Figure 1. Distribution of pole-and-line skipjack catch for the years 1982 through 1985. The "?" symbols indicate area where data coverage is incomplete.

Figure 2. Distribution of purse-seine skipjack catch for the years 1982 through 1985. The "?" symbols indicate area where data coverage is incomplete.

Figure 3. Trends in pole-and-line (dotted line) and purse-seine (solid line) fishing effort in the area between 1000°N and 1500°S and 14000°E and 18000°E. Effort is expressed as the sum of boat-days fished and boat-days searched.

Figure 4. Trends in pole-and-line (dotted line) and purse-seine (solid line) skipjack catch in the area between 1000°N and 1500°S and 14000°E and 18000°E.

Figure 5. Trends in catch per unit of effort for skipjack by pole-and-line (dotted line) and purse-seine (solid line) vessels in the area between 1000°N and 1500°S and 14000°E and 18000°E. Effort is expressed as the sum of boat-days fished and boat-days searched. Individual symbols indicate average over year.

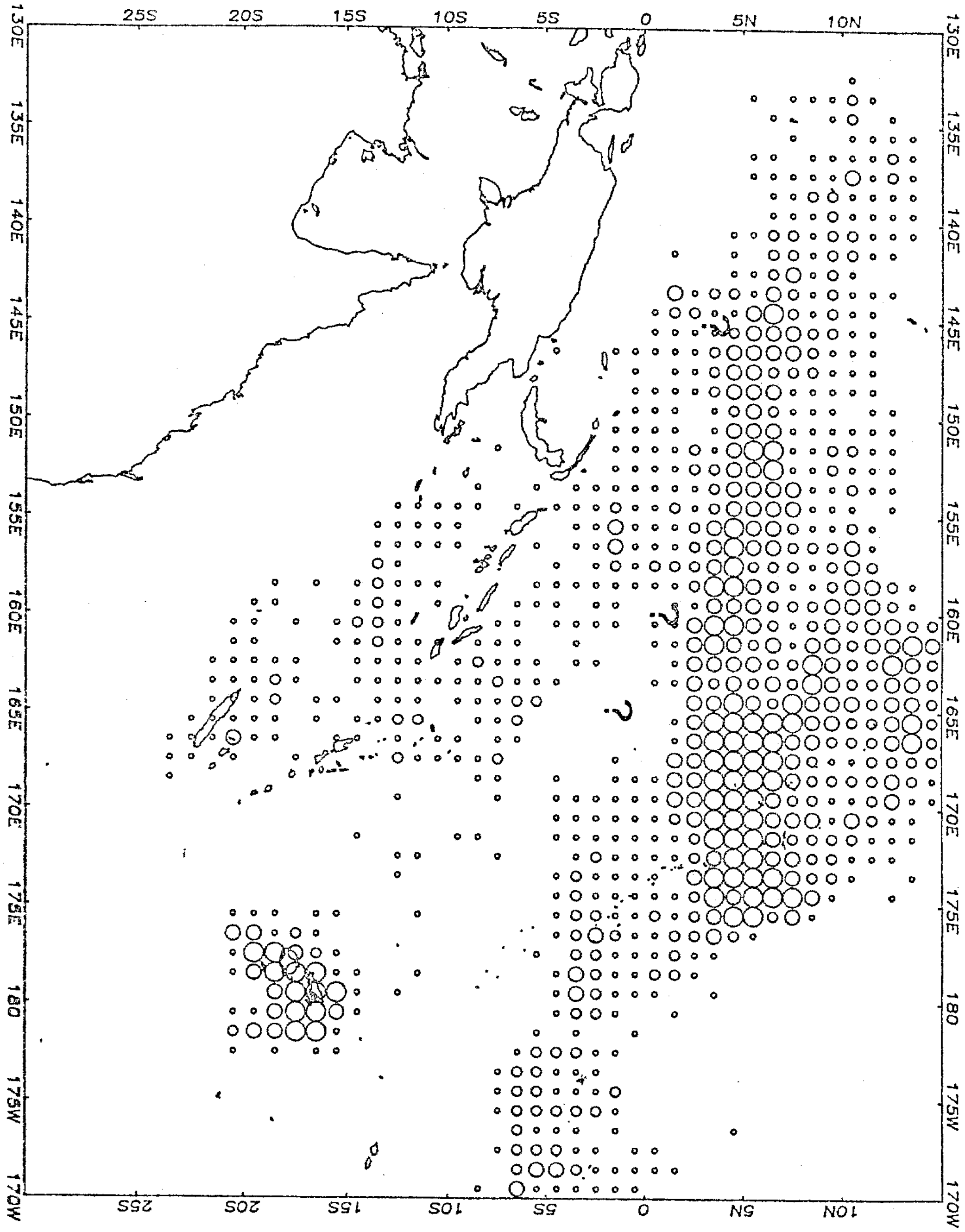
Figure 6. Relationship between skipjack catch and effort for purse-seine vessels (+) and pole-and-line vessels (o) in the area between 1000°N and 1500°S and 14000°E and 18000°E. Straight lines indicate average CPUE.

Figure 7. Yellowfin catch by purse-seiners as a function of skipjack catch in the area between 1000°N and 1500°S and 14000°E and 18000°E.

Figure 8. Straight line representations of movements of skipjack tagged by the Skipjack Programme and subsequently recovered. Movements plotted have been selected to show no more than two examples between any pair of ten-degree squares, one in each direction, and no more than two examples of movement wholly within any ten-degree square. Tick marks on the arrows represent time-at-large with one tick mark per 90-day interval (from Kearney 1983).

Figure 9. Numbers of tagged skipjack recovered at different distances from point of release (from Kearney 1983).

Figure 10. Mean square of distance travelled (nautical miles) for tagged skipjack at liberty for different periods of time. Only fish moving less than 200 nmi have been included. Error bars indicate two standard errors on each side of the mean.



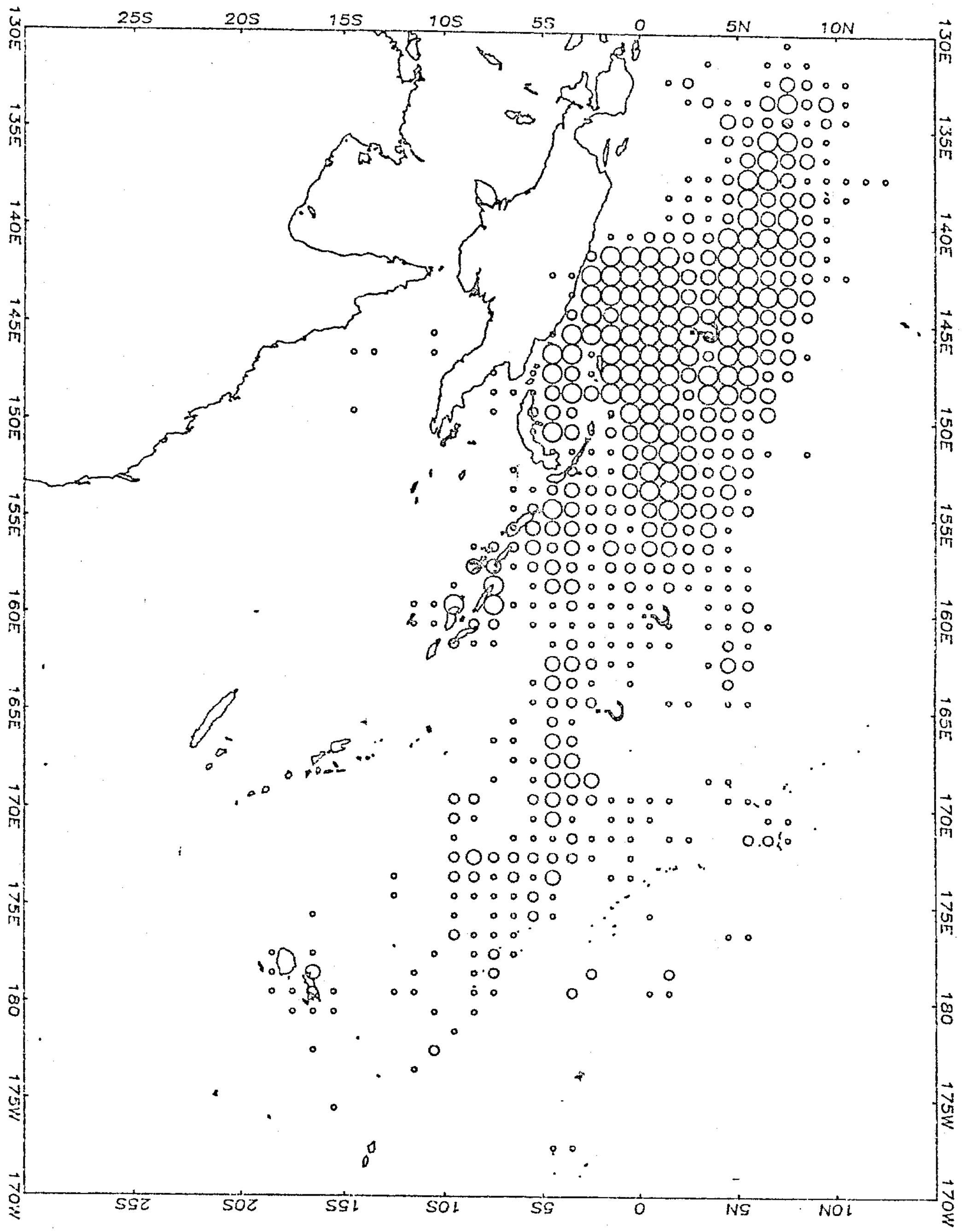

1 to 50 tonnes

51 to 150 tonnes

151 to 400 tonnes

More than 400 tonnes

*Figure 1*




• 1 to 150 tonnes

o 151 to 500 tonnes

o 501 to 1200 tonnes

O More than 1200 tonnes

Figure 2

*Figure 3*

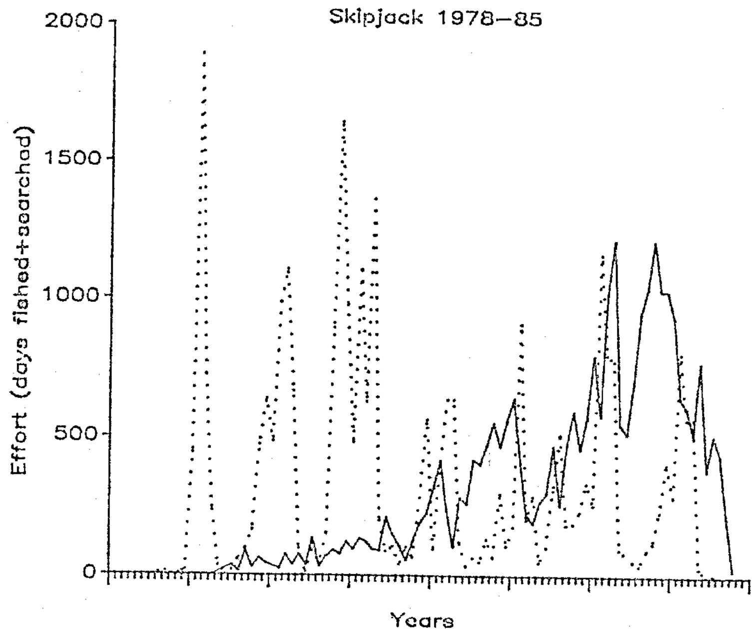



*Figure 4*

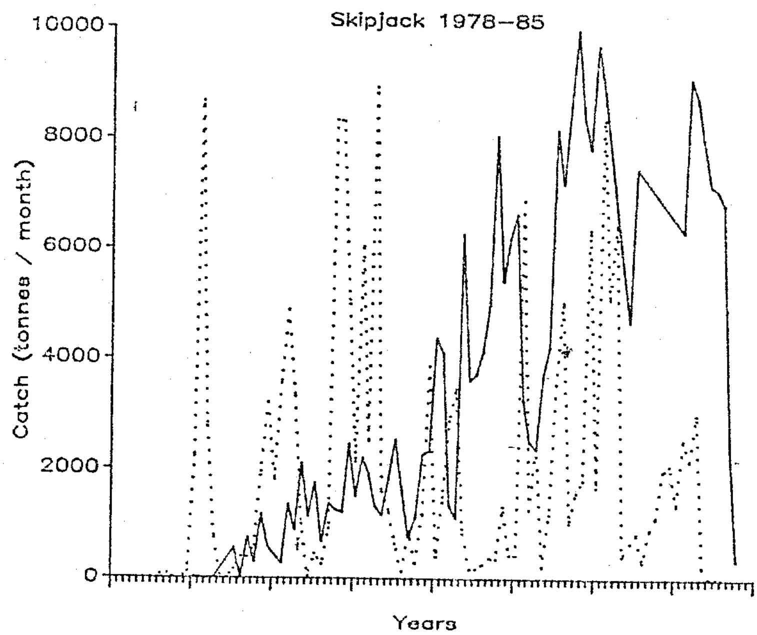


*Figure 5*

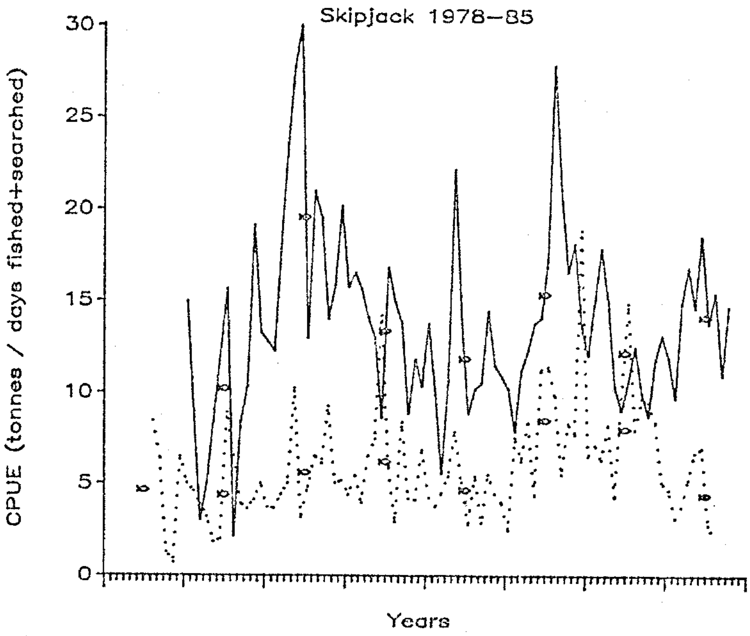
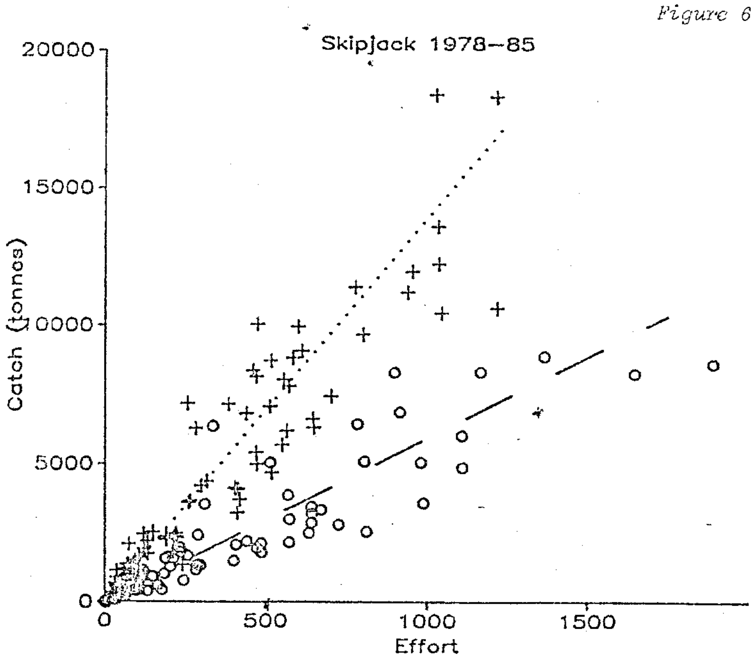



*Figure 6*



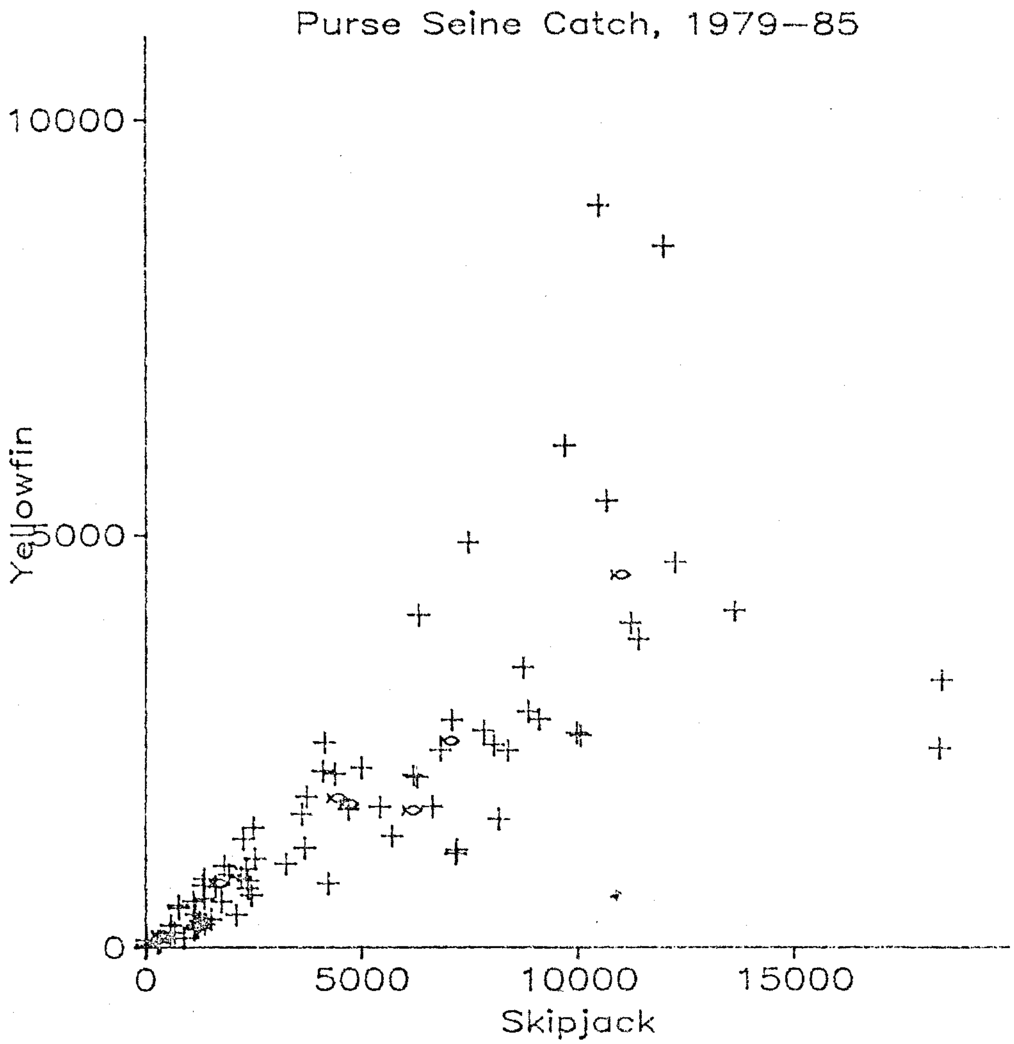

Purse Seine Catch, 1979-85
10000
5000
0
Yellowfin
0
5000
10000
15000
Skipjack

*Figure 7*

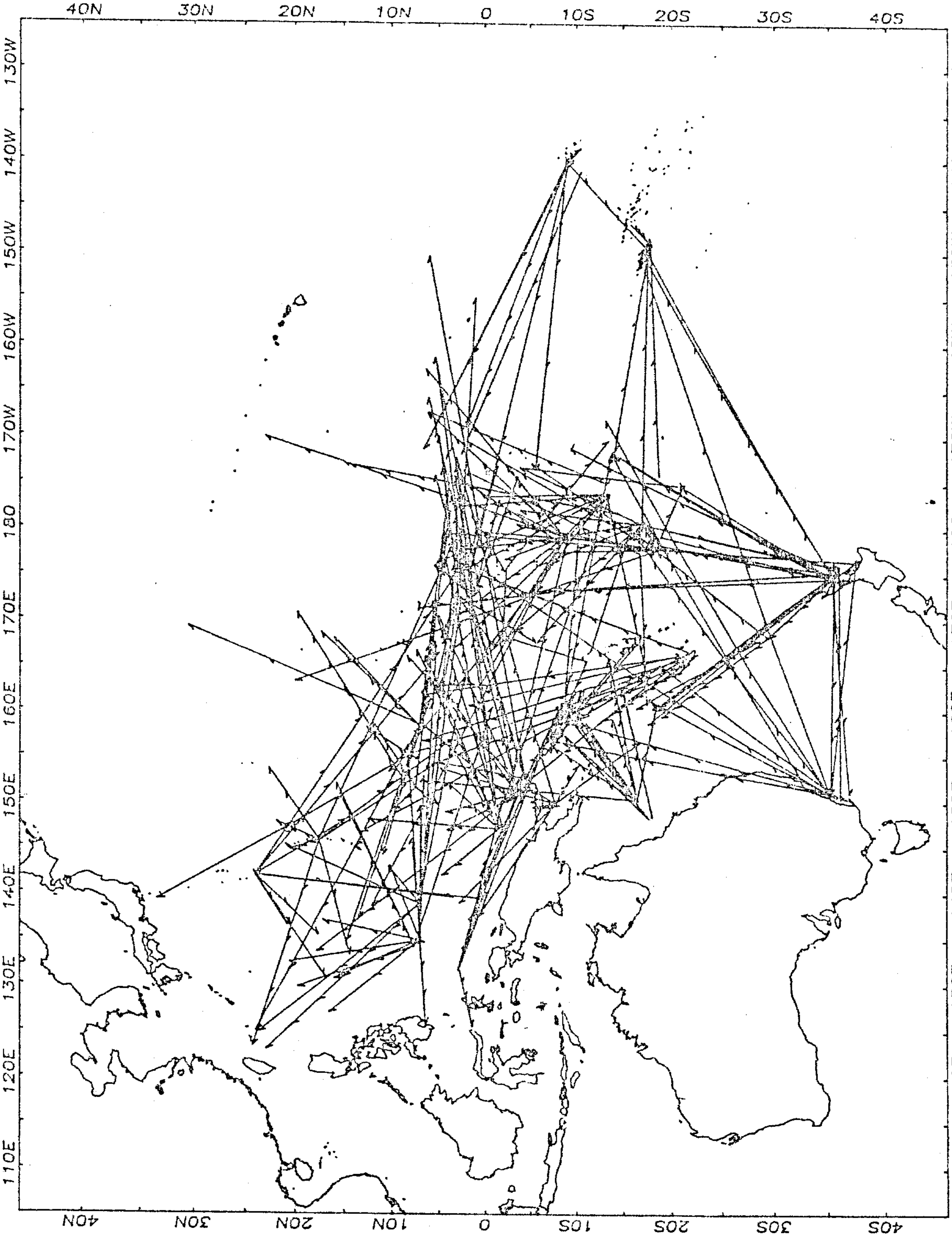
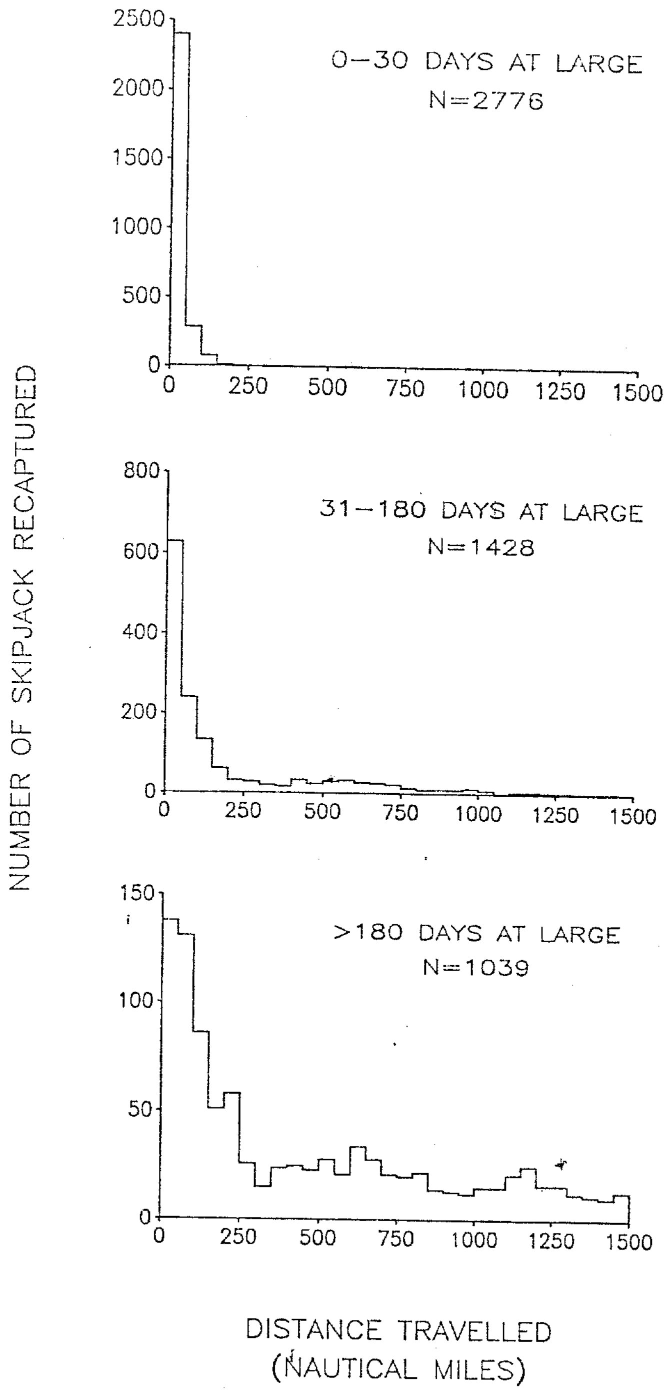
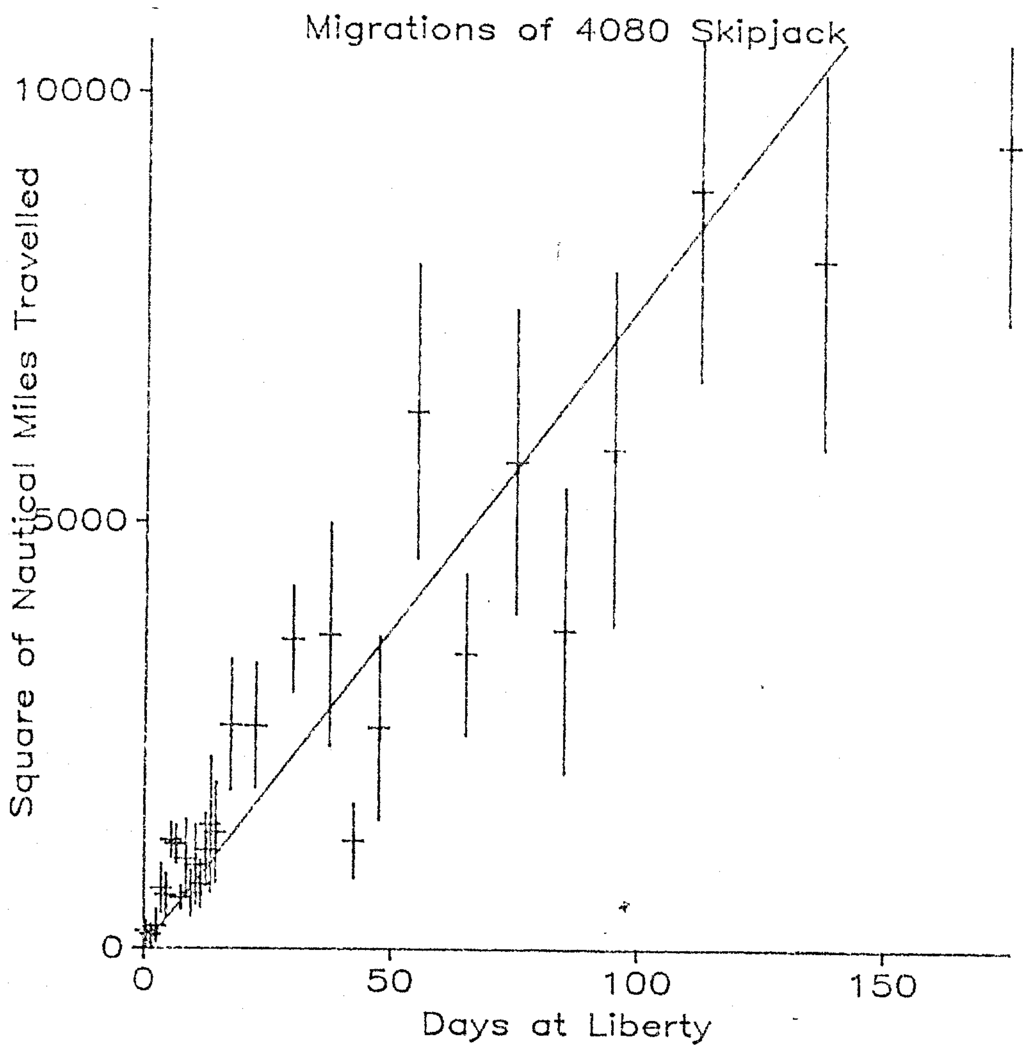

40N
30N
20N
10N
0
10S
20S
30S
40S
130W
140W
150W
160W
170W
180
170E
160E
150E
140E
130E
120E
110E

*Figure 8*



2500
2000
1500
1000
500
0
0 250 500 750 1000 1250 1500
0–30 DAYS AT LARGE
N=2776
800
600
400
200
0
0 250 500 750 1000 1250 1500
31–180 DAYS AT LARGE
N=1428
150
100
50
0
0 250 500 750 1000 1250 1500
>180 DAYS AT LARGE
N=1039
NUMBER OF SKIPJACK RECAPTURED
DISTANCE TRAVELLED
(NAUTICAL MILES)


*Figure 9*



Migrations of 4080 Skipjack
10000
5000
0
Square of Nautical Miles Travelled
0
50
100
150
Days at Liberty


*Figure 10*